Leveraging the Growth of Open Access in Library Collection Decision Making

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A primary goal for collection management is assessing the relative value of continuing information resources. A variety of new environmental factors and data are pertinent to relative value. One of the emerging metrics is the degree to which the articles within a subscription journal are also available open access (OA). That OA level directly affects the value of a journal subscription. This paper outlines a theoretical model for accounting for open access in decision making by proposing an Open Access-adjusted Cost per Download metric. Refinements to the metric are also discussed, as well as how it can be applied, and the broader scholarly communication implications of leveraging open access in library decision making.

Introduction

Open access (OA) has thus far had more impact on authors and readers than on libraries. Over the past two decades libraries have moved toward licensing or purchasing electronic journals and books and managing access restrictions for their own communities. While librarians have set up institutional repositories to support sharing open access scholarship and advocated for open access, neither had much impact on where the library budget was spent.

As the level of open access approaches 50% overall (and far higher in some disciplines),[1] the fact that libraries do not take it into account in decision making for journal cancellations is notable. It is true that big deals make it effectively pointless to look at levels of OA overlap title by title. But as more libraries leave big deals, or begin scenario planning for the option,[2] the ability to apply relevant data and methods to inform the process is critical. Incorporating open access into a journal cancellation strategy also advances two high-level objectives for research libraries: achieving maximum impact for their limited resources; and advancing beneficial innovations in scholarly communication (presuming one sees OA as beneficial). Both objectives take as a given that library budgets are their parent institution's mechanism for subsidizing access to information resources for members of its community.[3] By extension, it is librarians' responsibility, in support of advancing scholarship, to employ new data and technologies, as they become available, to advance these goals.

Related Literature

A recent ARL SPEC Kit surveys collection assessment practices. The report highlights how assessment is undertaken for a wide variety of purposes; employs both global and local metrics; and employs special-purpose, rather than standardized, methodologies to address the questions of interest.[4] Two specific topics related to using open access in journal assessment are discussed in more detail below.

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Cost Per Download

For many questions related to assessment of discrete electronic resources, such as a journal, some measure of usage and cost are core data points. Usage data is typically obtained through COUNTER reports.[5] A ratio of cost to downloads (uses) is typically calculated: the Cost per Download (CPD, or Cost per Use, CPU). That the CPD is quantitative is useful, but it would never be the sole criterion in a serious journal collection analysis.

Open Access and Journal Cancellations

The substitution of alternative access methods (primarily interlibrary-loan and document delivery) is often part of the journal cancellation decision making process. The availability of an open access alternative has, with limited exceptions,[6] apparently not yet been employed in the context of a broad-scale assessment of subscription journals.[7] While OA journals and OA collections was noted as data points of interest, article-level OA was not listed as a data point used in collection assessment by any library in the 2015 ARL SPEC Kit.[8]

The question of using open access to make journal cancellation decisions has been controversial since the earliest discussions of open access.[9] This was inevitable owing to the self-evidently decreasing value of a subscription as the amount of OA content in that journal increases. In fact, for the first and most vociferous proponent of Green OA, Steven Harnad, who spent years arguing that we need not worry about Green OA and cancellations, himself stated that cancellations and their attendant distruption are a necessary precursor to a functional Gold OA journal market.[10]

For a period of time Green OA advocates were asserting, almost as if it were a natural law, that Green OA does not lead to cancellations.[11] That period was followed by simple statements that OA is not used in making cancellation decisions.[12] Now there is the recognition that cancellations are likely to result once "a critical mass of articles across a range of journals becomes OA" (i.e., Hybrid OA) or "a large enough volume of OA articles from those titles" becomes OA (i.e., Green OA).[13] One of the reasons librarians give for their reluctance to cancel based on OA availability is that the pre- and postprint versions of articles are not considered good enough substitutes for the final versions.[14] But the quantity of OA, in all its flavors, including a significant and growing amount of "Robin Hood" OA that is predominantly the publisher PDF version but resides outside institutional repositories, is such that it's not a question of whether OA will lead to journal cancellations but when and how. The "substitutability" concept of also sets a higher threshold than looking at how the availability of OA in subscription ournals affects the value of those journals. Substitution leads to the question of how much of a journal would have to be OA in order to cancel the journal, implying that the decision rests solely on the degree of overlap. The substutability question is about saving the time of the reader, not requiring a reader to use an "inferior" copy of an article; even if it were not considered cost-effective, the library can always procure the publisher version of an article for a reader. Viewing the toll-OA overlap as one component of a broader assessment of a journal's relative value aligns better with the reality that cancellation decisions are not made based on a single factor; the concept of relative value itself implies that a journal assessment exercise results in a continuum of titles, in fact, not independent binary decisions.

The implicit publisher-librarian bargain that underlies Green OA (i.e., if the publisher allows Green OA then libraries will maintain subscriptions and be able to set up successful IRs) was fragile from the beginning. It was underpinned by hopes and assumptions about actions of the other player that were neither based in data nor aligned with each player's predictable, incentive-driven behaviors. Gadd and Covey studied increases in embargo restrictions over time and provide strong evidence that publishers have not respected this implicit bargain, likely because the development of an author-facing market became possible.[15] Also likely is that librarians will not respect this "bargain" either when it is beneficial and practically possible for them to act on their own economic incentives.

The Changing Relative Value of Journal Subscriptions

Factors Devaluing Journal Subscriptions

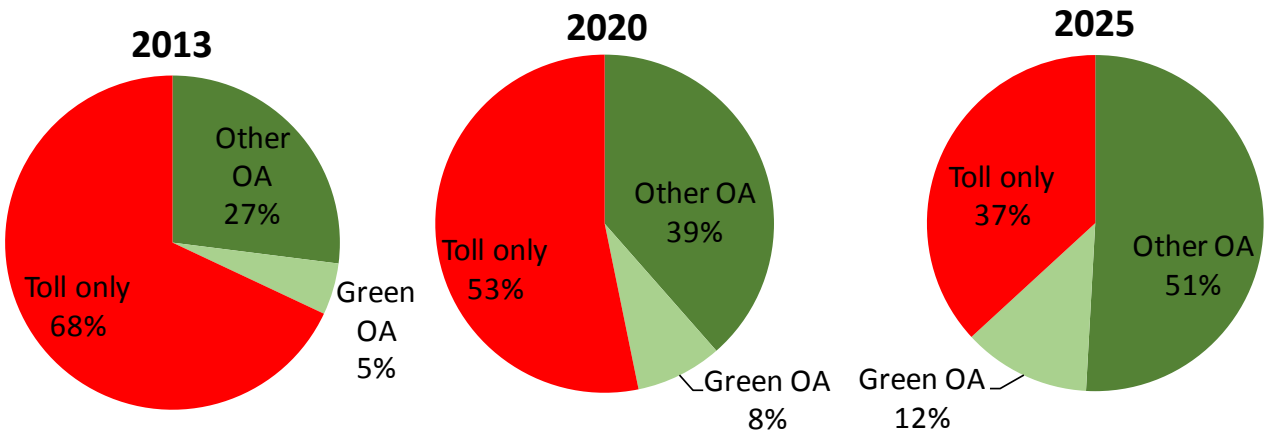
Libraries employ a range of access mechanisms—license, borrowing, purchase, and one-time acquisition—to provide their communities with the information resources they need. Librarians have always adapted their assessment strategies in response to changing environmental factors and available data. The increasing accessibility of scholarly content outside traditional subscription journals is one such environmental factor that is clearly relevant. While it is at present challenging to quantify and to act upon, there is enough good data available now at the title level to begin to develop a methodology for how it can be integreated into decision making. Using open access to contribute to decision making is conceptually an extension of the now well-established practice of not paying more than once for the same content.

When titles that are considered core are next to be canceled, or important new titles cannot be added, all available data relevant to the relative value of titles is of interest. No library pays to obtain access to a Gold OA journal, yet libraries continue to pay full price for journals that are fully open access after a short period of time (as little as 6 months) and journals most of whose articles are freely available as Green OA. Even though it may be hard to quantify, it is self-evident that these journals have lower relative value than a journal that has low OA content.

The figure below shows how the projected growth in OA over time intersects with the set of subscription journals the library purchases (thus the growth of Gold OA journals is not reflected here).[16] As content accessible only through a subscription shrinks as a proportion of all subscribed content (and as costs not only do not shrink but continue to rise), the relative value of subscribed journals declines rapidly. In a rough hypothetical example, for a title that is 50% open access immediately, the library subscription saves the reader minutes for half the articles/downloads (the OA half) and non-negligible extra effort and time for the other half (the toll-only half). Each subscription journal has some combination of hard-to-get and easy-to-get content.

FIGURE 1

Projected growth of OA in subscription journals



Irrespective of how journals are sold, distributed or consumed, a core collection management activity is assessing the relative value of journals along with qualitative and quantitative dimensions, with respect to their cost, their value to the community, and with respect to other journals in the collection and those not acquired. Several additional factors that decrease the relative value of journal subscriptions are discussed briefly below.

Future Readers

Journals are "two-sided platforms,"[17] meaning that they support both authors and readers. Journal subscriptions primarily support readers, both current and future. In the print-based era, libraries were incentivized to act conservatively in canceling subscriptions and taking on new ones because of the unknown demand of future readers as well as the costs, in several senses, of incomplete journal runs. With ejournals, because any gap can easily be filled at much lower annualized cost than the price of next year's subscription, there is no longer the need to be hold flexibility in the present hostage to unknowns in the future.

Journals with Fewer Readers

In disciplines where readers have already seen virtually all articles that are eventually published in journals, library subscriptions (or equivalent payments to publishers), simply serve to maintain those journals' role in the current credentialing system for authors. No value judgment need be placed on that function to recognize that those subscriptions have lower relative value—all other factors being equal— than journals that also support current and future readers.

Many scholarly journals have significantly smaller audiences for another reason. The open internet and article databases, supported by library integrated index discovery services, have provide a good job of supporting undergraduate research needs. As a result, subscription journals now primarily serve researchers.

Faster, Easier Alternative Access

Readers have many ways to access full text that does not involve the library at all. Professional networks have always supplied researchers with needed articles—now an expanded path to access through social researcher collaboration platforms. Open access content is also readily accessible from many sources with publicly available sources conveniently aggregated by GoogleScholar.

When the reader turns to library services, they find that the state of the art in interlibrary loan and document delivery has improved substantially over the past decade. With new service provider options, such as RapidILL and ReprintsDesk, delivery times have moved from days to hours, or even minutes in the case of unmediated document delivery. A large proportion of a library's expenditures for licensed journal subscriptions have always gone not toward providing access per se but toward lowering access barriers—whether the barrier be cost or the reader's time. As the reader's time saved by a subscription shrinks substantially, the value of the convenience afforded by a journal subscription declines.

Defining the Open Access-adjusted Cost Per Download

Cost per Download (CPD), or Cost per Use, is one data point that contributes to assessing relative value across titles.[18] The simple CPD calculation averages the journal price across downloads of all articles in a given journal (often limited to a given publication year and/or given year of usage). Those download counts would include any OA articles that are hosted by the publisher.[19]

The Open Access-adjusted Cost Per Download (OA-adj CPD) is a proposed metric that subtracts the downloads that could be met by OA copies of articles within subscription journals. In this simple model it discounts it entirely, but that could easily be adjusted for the degree to which each institution felt OA copies could substitute for subscription copies.

The model projects forward three years for two reasons. First, because the typical Green OA embargo period is 12 months, there is a substantial increase in available OA content after one year. Second, the CPD for the next subscription year does not account for the value of "lost" content with each successive year.[20]

The data for price and usage was drawn from the normal sources (publisher, subscription agent, COUNTER). The OA level by title and year was drawn from the 1science oaIndx and acquired by Caltech in an institutional oaFigr report.[21] The data is based on Web of Science (now Clarivate Analytics) and 1science estimates that it captures 70–80% of OA in WoS-indexed journals.[22]

Limitations

Because of data availability and in order for the OA-adjusted CPD to be simple enough to apply, this conceptual model does not account for several known issues. The first is that most of the data points for the future are estimated based on past data. As Couglin and Jansen point out, most metrics are historical; it is not typical to project data points related to value, such as future downloads or citations, more than a year into the future. The OA-adjusted CPD relies on projections of future costs, downloads, and OA levels.

It is particularly challenging to estimate the level of OA for a given journal year, much less future levels of OA—both are moving targets due to backfill OA and the difficult-to-predict overall growth trajectory for OA. An additional limitation in using OA levels to adjust Cost per Download is lack of information relevant to the quality of the OA copy. While 1science's oaIndx harvests only from vetted repositories, there are important distinctions in types of Green OA that relate to substitutability.[23] Were OA levels by type available, institution-level choices could be made as to which OA to include or exclude, or to assign differential weights, in an OA-adjusted CPD.

Because delivering an OA copy to the reader is not as easy as delivering the reader a subscribed copy, the assumption in the simplified OA-adjusted CPD model makes that the OA copy is fully equivalent is clearly an over simplification. In fact, library discovery and delivery infrastructure does a poor job of exposing and delivering OA copies. Fortunately, GoogleScholar handles this quite seamlessly through OpenURL integration plus the "all versions" feature. There are other aggregated sources of OA content, as well, such as oaFindr[24] from 1science, SHARE[25] and CORE,[26] among others. The time penalty between toll and OA copies is thus decreasing; in fact, often the OA copy is easier to access than the toll copy due to clunky authentication and authorzations hurdles.

Calculating the Simple OA-adjusted CPD

The OA-adjusted CPD is conceptually simple: it is a standard cost per download calculation that discounts downloads that could have been supplied by OA copies of articles. For example, if there were 100 downloads of a journal's prior year content in the prior year (the COUNTER JR5 report), and the estimated OA level for that year's content at the time it was measured was 10%, then the adjusted downloads would be 90.

Data elements for a simple OA-adjusted CPD include: projected price; COUNTER JR5 PDF downloads of the last complete year, , which are used to estimate future years; and the estimated OA level based on prior OA levels[27] The OA-discounted download data is averaged over three years.

With being the prior three years, the current year, the next three subscription years

The simple OA-adjusted CPD is

$$\left[\frac{Price_{y2}}{JR5_{y0}\times(1-OA_{y0})}+\frac{Price_{y3}}{JR5_{y0}\times(1-OA_{y-1})}+\frac{Price_{y4}}{JR5_{y0}\times(1-OA_{y-2})}\right]\times\frac{1}{3}$$

Application of the metric, and how it compares to the standard CPD, is illustrated below.

Applying the Simple OA-adjusted CPD to Journals

Nine sample Caltech Library subscribed titles were selected to calculate the OA-adjusted Cost per Download and to

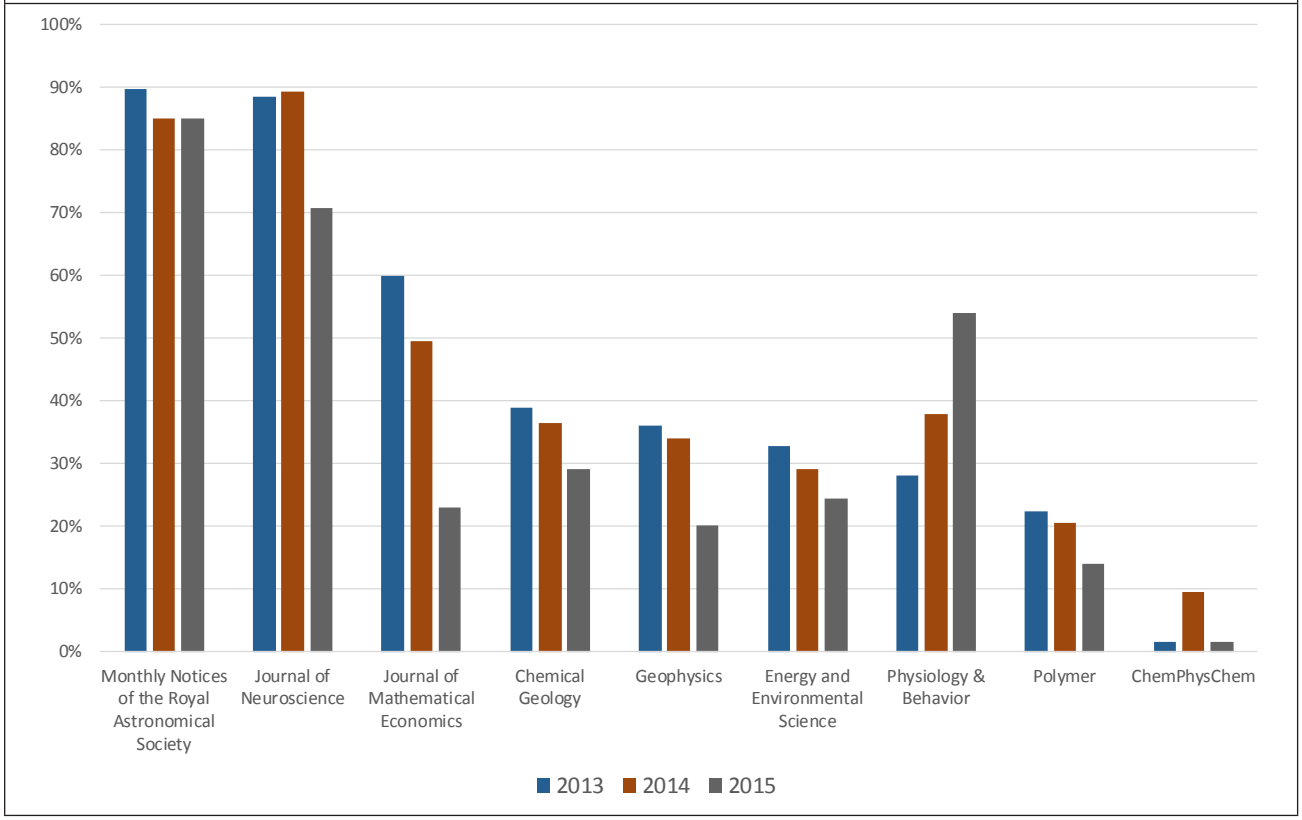
compare it to an unadjusted Cost per Download calculation. The titles selected vary significantly in levels of use, subscription price, and OA levels. The download and price data for the titles is shown in Table 1, and OA data in Figure 2.

TABLE 1
Sample journal titles, with Caltech Library data, for testing simple OA-adjusted CPD

Journal	JR5	Price
Chemical Geology	360	$7,841
ChemPhysChem	20	$4,021
Energy and Environmental Science	2,027	$2,823
Geophysics	46	$774
Journal of Mathematical Economics	23	$2,399
Journal of Neuroscience	802	$4,249
Monthly Notices of the Royal Astronomical Society	2,406	$10,011
Physiology & Behavior	64	$7,315
Polymer	94	$11,540

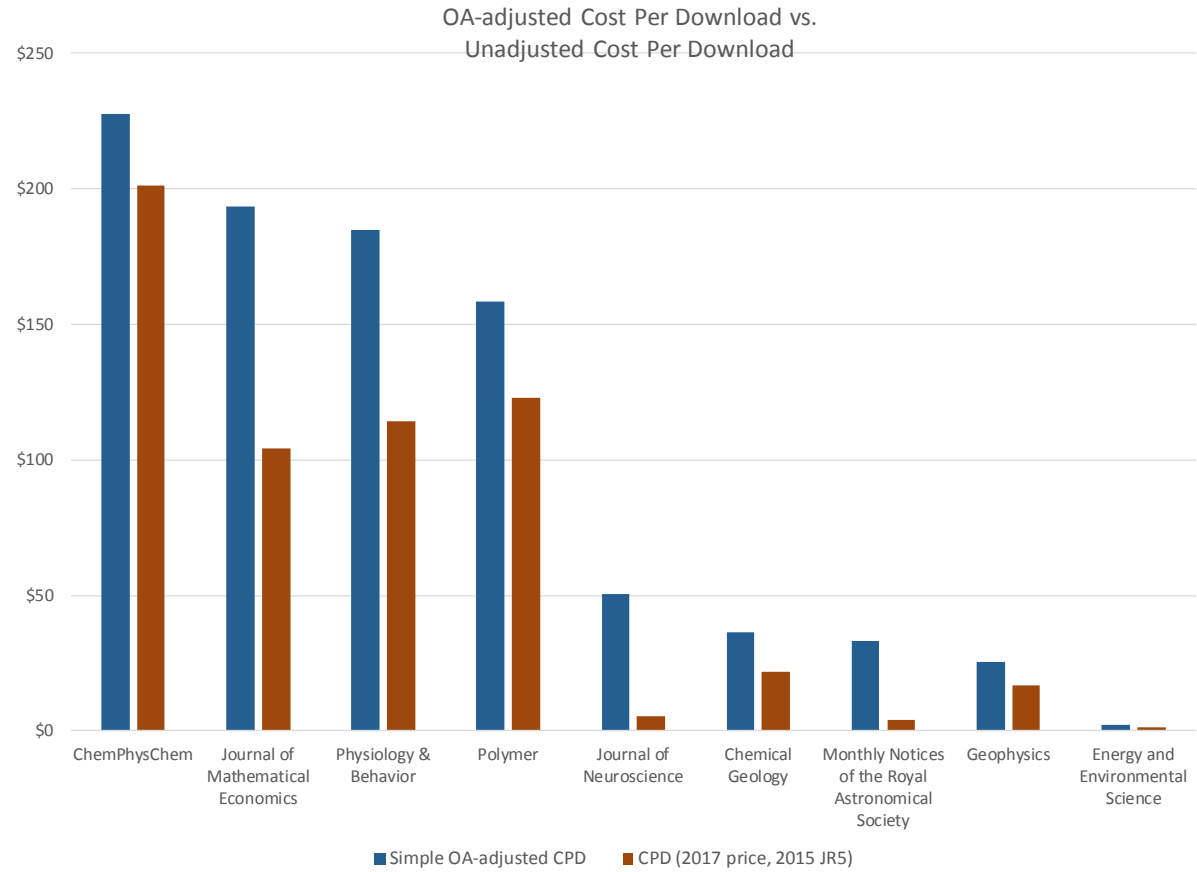
Figure 2 shows the OA levels, 2013–2015, for the titles in the sample.[28] This data is sufficient to demonstrate that different titles have substantially different OA profiles; it is not sufficient to draw extensible conclusions about how any given title's OA level changes over time.

FIGURE 2
Snapshot OA levels 2013-2015 for sample Caltech titles.
Source: June 2016 1science oaFigr subscription report



In Figure 3, the OA-adjusted CPD formula was applied and compared with an unadjusted CPD calculation for the sample titles.

FIGURE 3
OA-adjusted CPD and unadjusted CPD for nine sample Caltech titles



Calculating an Enhanced OA-adjusted CPD

The simple OA-adjusted CPD ignores a number of factors relevant to assessing journal value. Were the data available to refine the methodology, the accuracy of the OA-adjusted CPD could be improved. Six relevant additional data points are discussed briefly below. Most are independent and could be used alone or in conjunction with each other.

Favoring Newer Content

The simple OA-adjusted CPD averages the OA levels for the most recent three years. Clearly, newer content, i.e., content that falls within the typical 12-month embargo period, is of disproportionately high value and may be the reason why the library continues to subscribe to the title. In this case, one could weight the most recent year's OA level by some factor higher. For example, if it were considered twice as valuable as the prior two years' content, the adjustment to the calculation would be

$$\frac{Price_{y2}}{JR5_{y0}\times(1-OA_{y0})}\times\frac{1}{2}+\left[\frac{Price_{y3}}{JR5_{y0}\times(1-OA_{y-1})}+\frac{Price_{y4}}{JR5_{y0}\times(1-OA_{y-2})}\right]\times\frac{1}{4}$$

Delayed OA Journals

Delayed OA titles, where all content is available after a given embargo period, comprise at least 500 journals, many high-impact titles, according to a recent study.[29] For these titles, the OA-adjusted CPD calculation can be simplified according to the embargo period. For example, the OA-adjusted CPD for a Delayed OA title with a 12-month embargo would be

$$\frac{Price_{y2}}{JR5_{y0}\times(1-OA_{y0})}$$

Journals without Post-cancellation Access

A subset of managed journals will be titles that are not licensed for post-cancellation access. Because all usage is relevant to CPD for those titles, one would substitute the COUNTER JR1 report (all usage) for the JR5 report.

Total Cost of Publication

The total cost of publication with a given publisher has become a data point of interest in conjunction with funding the transition to open access, notably in the UK.[30] The total cost of publication includes all costs borne by the institution related to publishing in a journal (author charges) and accessing the journal (reader charges). Author charges could include the category of publication charge sometimes referred to as page charges, as well as Article Processing Fees (APCs).[31]

To modify the simple OA-adjusted CPD to reflect Total Cost of Publication, one would replace Price with Total Cost, which sums price and projected total author charges. Thus, a Total Cost OA-adjusted CPD is

$$\left[\frac{Total\ Cost_{y2}}{JR5_{y0}\times(1-OA_{y0})}+\frac{Total\ Cost_{y3}}{JR5_{y0}\times(1-OA_{y-1})}+\frac{Total\ Cost_{y4}}{JR5_{y0}\times(1-OA_{y-2})}\right]\times\frac{1}{3}$$

Green vs. Gold Open Access

Because Green OA may not be considered overall to be as substitutable for subscribed access as Gold OA, if the relative proportion of Green vs. Gold OA were available by title, then Green OA could be discounted by some fraction.

Thus, where represents the estimated proportion of Gold OA, and the estimated proportion of Green OA, and is the fraction by which Green OA is discounted, then

$$\left\{\begin{array}{c}\frac{Price_{y2}}{JR5_{y0}\times\left[(1-GOA_{y0})+(1-nGrOA_{y0})\right]}+\frac{Price_{y3}}{JR5_{y0}\times\left[(1-GOA_{y-1})+(1-nGrOA_{y-1})\right]}\\+\frac{Price_{y4}}{JR5_{y0}\times\left[(1-GOA_{y-2})+(1-nGrOA_{y-2})\right]}\end{array}\right\}\times\frac{1}{3}$$

Backfill Open Access

OA backfill (e.g., how much more 2014 content is OA in 2016 than was OA in 2015) is a significant—and growing[32]—contributor to the growth of open access overall, although difficult to calculate year-on-year. If there were some mechanism to estimate the rate of backfill OA for the second two years of the estimation, and , an adjustment could be applied.

$$BackfillEnhancedOA_{y3}=OA_{y-1}\times 1.n_3$$
$$BackfillEnhancedOA_{y4}=OA_{y-2}\times 1.n_4$$

Using the OA-adjusted CPD

Any title-level assessment methodology makes sense to apply where title-level decisions are both useful and possible. In any research library collection, only a minority of journal titles to which the library has access are useful to manage at the title level. Many other, unmanaged, titles are located in article databases or predefined packages, where titles move in or out outside the library's control. Some managed titles will be part of bundles or big deals that have license restrictions on how they can be canceled. In the case of bundles and big deals, when it is either not possible to know the price of an individual title or to act on that information, the aggregate change in a relative value of the bundle or big deal the level of toll-OA overlap could be assessed.

Application of the OA-adjusted CPD is analogous to a CPD calculation in a multi-factor evaluation of journal titles. One can imagine setting different OA-adjusted CPD thresholds based on the relative value of journals, as discussed in section 3. For example, a library receives lower value for a title that is no longer serving readers and so would set a lower OA-adjusted CPD threshold for those titles. Similarly, a higher OA-adjusted CPD threshold would reflect another title's importance to institutional priorities.

The OA-adjusted CPD is a conceptual bookend to other access mechanisms in lieu of a journal subscription, typically ILL and document delivery. Just as a journal assessment project will look at the potential cost of the ILL/document supply option in setting a CPD threshold for cancelation, the OA-adjusted CPD builds in a measure of substitutability based on open access copies of articles.

Conclusion: Supporting New Models for Scholarly Communication

From the perspective of the individual institution, transformation of the broader scholarly communication system will always be indirect. Each research library can focus on journal value, supporting new OA models where applicable, and making decisions that support management flexibility suitable for a rapidly changing environment. Since the library shields costs from journals' primary stakeholders (readers), the library bears the responsibility to be good stewards of those resources. If we choose not to use OA in decision making, even as the data becomes more readily available and reliable, we are not being good stewards of our institutional resources, and we are not serving future researchers as much as we could be through development of collectively heterogeneous and deep collections.[33] One of the broadest questions research libraries are faced with is an ethical one: are we perpetuating a legacy, and suboptimal, scholarly communication system that does not best serve either current or future researchers?

While the impact of the perpetuation of the traditional journal subscription model on research libraries' collective collection diversity is out of scope here, it is relevant to note that continued commitment to the model, especially in the form of a big deal, constrains experimentation with—and adoption of—new OA funding models. The resulting lack of budget flexibility, even in the presence of organizational will to make substantive changes, consigns OA-related initiatives to the margins where they are largely disconntected from the core players and systemwide economic forces.

Transition to a competitive OA journal market will require disruption of the current market.[34] Until libraries use all available data, including about OA, to reduce expenditures on traditional subscription journals, large publishers will continue to develop a separate author-facing market (Hybrid OA) and to restrict non-market OA (Green). A meaningfully reduced spending on traditional subscription journals will push lower value journals into unsustainability as subscription journals; they may then become viable through competing for authors as Gold OA journals, or they may be nonviable and be eliminated. The OA-adjusted Cost per Download is one tool to support libraries in leveraging, and even just thinking about, all of the data that is available to us in a rapidly changing scholarly communication landscape.

Notes

1. Archambault et. al., 34.
2. Nabe and Fowler; Blecic et. al.; Scott; Dawson (2014); Dawson (2015); Jones et. al. (2013).
3. Lewis (1998).
4. ARL SPEC Kit 352, 8–13.
5. ARL SPEC Kit 352, 14. Data accuracy, comparability and interpretation is out of scope but clearly has an impact on the utility of the CPD metric in any specific application.
6. Enoch & Harker describe using open access in the context of assessing the value of Delayed OA journals.
7. Lehman, 172–3; Johnson, 435.
8. ARL SPEC Kit 352, 25, 19–20.
9. Esposito, Sept. 26 2013.
10. "If and when 100% Green OA should cause significant cancellation pressure (no one knows whether or when that will happen, because OA Green grows anarchically, article by article, not journal by journal) then the cancellation pressure will cause cost-cutting, downsizing and eventually a leveraged transition to OA (Gold) publishing on the part of journals." Harnad, 99.
11. Esposito, October 3, 2013.
12. Ware; Rizer and Holley, 327; Geraldine Hoskins reports on a study which recommendation that "South African university libraries must know what percentage of their libraries' journal content is freely available." 589.
13. Levine-Clark, 430. Also, see Lewis (2012), 503.
14. Rizor and Holley, 327, 330.
15. Gadd and Covey showed restrictions on self-archiving have grown substantially since 2004 and this correlated with the creation of hybrid OA in response to funder mandates. Covey showed that top publishers, and for-profit publishers (i.e., those who were developing the APC-based Hybrid OA article market), accounted for most changes in SHERPA/ROMEO policies.
16. The 2017 baseline and annual growth rates are estimated based on historical growth of OA as reported in Archambault, et. al., 31–33. Those historical data were: Green OA grew 8.8% annually 1997–2011; and Other OA, which includes articles in Hybrid OA journals, repositories such as PubMed Central, and "Robin Hood" OA, grew 8.4% annually 1996–2009 and 6.6% annually 2003–2012 (6.6% growth was used to calculate the figures).
17. McCabe, 2007.
18. ARL Spec Kit; Davis and Day.
19. Future development of the COUNTER JR1GOA report may enable deduction of Gold OA articles from the JR5 report. See Bobal and Emery.
20. Assuming it is not known when or if the content will become 100% OA.
21. OaFigr is a customized bibliographic analysis of an institution's active journal subscriptions. http://www.1science.com/oafigr.html.
22. Eric Archambault post to eprints.org mailing list, June 30, 2016. https://www.mail-archive.com/goal@eprints.org/msg11440.html.
23. Archambault, et al., 3–4.
24. http://www.1science.com/oafindr.html.
25. https://share.osf.io/.
26. https://core.ac.uk/.
27. Data available in the 1science oaFigr subscription report.
28. Source: Caltech institutional oaFigr report, run June 2016. The report included OA level data from 2008–2015.
29. Laakso and Bjork.
30. Pinfield, et. al.
31. Publication charges are still common for society subscription journals. According to a 2009 study of authors publishing in learned society publications, 30% "always" or "usually" paid page charges, while another 42% sometimes paid. Morris and Thorn, 226–227.
32. Archambault, et al., 30–31.
33. In 1973 the median percent of ARL library materials budgets devoted to serials was 16%, in 1986 that had risen to 56%, and in 2014 it was 78%. At the same time, between 1987 and 2015, overall library expenditures increased 28% (in constant 2015 dollars); serials expenditures increased 146%, and monograph expenditures declined 11%. This shift reflects changes in both scholarly communication practices and the scholarly information market over past 60 years. Library decisions taken during that time, in particular widespread adoption of the Big Deal, have played a role in this shift. Jones and Courant.
34. McCabe and Snyder. Schimmer notes, "The transformation of academic publishing to OA requires a reallocation of budgets and the conversion of journals to a new publication basis through the redesign of the processes."

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